3.0 AFFECTED ENVIRONMENT

This chapter describes the existing conditions at the proposed project area in relation to each of the resource areas addressed in this EA. This information serves as a baseline to identify and evaluate environmental changes that would result from the Proposed Action.

The Draft Central Valley Project Improvement Act Preliminary Environmental Impact Statement (U.S. Bureau of Reclamation 2000) divides the project area into two sub-areas:

- The **San Joaquin River Region** consists of all or portions of Calaveras, Fresno, Madera, Mariposa, Merced, San Joaquin, Stanislaus, and Tuolumne counties. The San Joaquin River and Fresno Slough divide this region into eastern and western subregions.

- The **Tulare Lake Region** includes all of Kings County and the western portions of Tulare and Kern counties. State Highway 99 divides the Tulare Lake Region into eastern and western subregions.

Where applicable, discussion of the Affected Environment has been divided into these sub-areas.

3.1 HYDROLOGIC RESOURCES

Water resources include surface water and groundwater and their physical, chemical, and biological characteristics. Surface water includes lakes, rivers, streams, canals, and wetlands, which have many uses including water supply, irrigation, and recreation. Such uses compromise important habitats for aquatic and terrestrial organisms. Aquatic and wetland habitats are discussed in Section 3.2, Biological Resources. Groundwater refers to water below the surface of the earth that fills spaces and fractures in rocks and sediments. Groundwater is ultimately derived from precipitation that infiltrates the ground. Groundwater moves in response to pressure gradients at rates that vary from less than one meter per year in relatively impermeable rocks to kilometers per day in highly permeable aquifers. Groundwater resources are used for household, municipal, and agricultural water supplies.

3.1.1 Surface Water

3.1.1.1 Regional Setting

The San Joaquin River Basin extends from the Delta in the north to the north fork of the Kings River in the south, encompassing about 32,000 square miles in the northern part of the San Joaquin Valley, roughly from Fresno to Stockton. The climate of the San Joaquin River Basin is semiarid, characterized by hot, dry summers and mild winters, except at the highest altitudes, where distinct wet and dry seasons prevail. Annual temperatures range from 20 to 100 degrees Fahrenheit (°F). Precipitation averages less than 6 inches per year and generally falls as winter rains. These infrequent rains are interspersed with periods of mild, sunny weather or dense fog. Most of the precipitation falls from November to April, with rain at the lower elevations and snow in the higher regions. On the valley floor, precipitation decreases from north to south, ranging from 14 inches in Stockton to 8 inches at Mendota (U.S. Bureau of Reclamation 2000).

The primary sources of surface water to the San Joaquin River Basin are rivers that drain the western slope of the Sierra Nevada Range. Each of these rivers, the San Joaquin, Merced, Tuolumne, Stanislaus, Calaveras, Mokelumne, and Cosumnes, drain large areas of high elevation watershed that supply snowmelt runoff during the late spring and early summer months. Historically, peak flows occurred in

May and June and flooding occurred in most years along all of the major rivers. When flood flows reached the valley floor, they spread out over the lowlands, creating several hundred thousand acres of permanent tule marshes and more than 1.5 million acres of seasonally flooded wetlands (U.S. Bureau of Reclamation 2000).

Extensive water supply, hydroelectric, and flood control efforts during the past century have resulted in the construction of dams and reservoirs that now control the flow on nearly all major rivers in the Central Valley (U.S. Bureau of Reclamation 2000).

Central Valley agriculture receives irrigation water from the CVP, the SWP, local water districts, individual water rights holders, and groundwater. Most of this water is delivered to farmers through irrigation districts and other water agencies. Deliveries average about 22.5 million acre-feet per year, with the SWP providing about 10 percent, local surface water rights about 30 percent, and groundwater about 35 percent. The CVP normally supplies about 25 percent of Central Valley water to approximately 200 water districts, individuals, and companies through water service contracts and water rights and exchange contracts.

Central Valley Project Operations

The CVP is the largest surface water storage and delivery system in California, with a geographic scope covering 35 of the state's 58 counties. The project includes 20 reservoirs, with a combined storage capacity of approximately 11 million acre-feet; 8 power plants and 2 pump-generating plants, with a combined generation capacity of approximately 2 million kilowatts; 2 pumping plants; and approximately 500 miles of major canals and aqueducts. The CVP supplies water to more than 250 long-term water contractors in the Central Valley, the Santa Clara Valley, and the San Francisco Bay Area.

In total these contracts amount to 9.3 million acre-feet which includes 1.4 million acre-feet of Friant Division Class 2 supply in wet years. Of the 9.3 million acre-feet, 6.2 million acre-feet is CVP water and 3.1 million acre-feet is water right settlement water. Average-year deliveries in the past decade have been around 7 million acre-feet. Water right settlement water is water covered in agreements with water rights holders whose diversions were in existence before the CVP was constructed. Since construction of CVP reservoirs altered the rivers' natural flow upon which these diverters had relied, contracts were negotiated to serve the users stored water to supplement river flows available under their rights. CVP water right settlement contractors (called prior right holders) on the upper Sacramento River receive their supply from natural flow and storage regulated at Shasta Dam; settlement contractors on the San Joaquin River (called exchange/transfer contractors) receive Delta water via the Delta-Mendota Canal as explained below.

Historically, approximately 90 percent of the CVP water has been delivered to agricultural users, including prior water rights holders. Total annual contracts exceed 9 million acre-feet, including over 1 million acre-feet of Friant Division Class II supply, which is generally available in wet years only. At present, increasing quantities of water are being provided to municipal customers, including the cities of Redding, Sacramento, Folsom, Tracy, and Fresno; most of Santa Clara County; and the northeastern portion of Contra Costa County.

Water stored in CVP northern reservoirs is gradually released down the Sacramento River into the Sacramento-San Joaquin Delta, where it helps meet demand along the river and quality and flow requirements in the Delta. The remainder is exported via the Contra Costa Canal and the Delta-Mendota Canal. Excess water during the winter is conveyed to off-stream San Luis Reservoir on the westside of the valley for subsequent delivery to the San Luis and San Felipe units. A portion of the Delta-Mendota exports are placed back into the San Joaquin River at Mendota Pool to serve, by exchange/transfer, water users who have long-standing historical rights to use of San Joaquin River flow. This exchange/transfer enabled the CVP to build Friant Dam, northeast of Fresno, and divert a major portion of the flow there farther south in the Friant-Kern Canal (and some water northward in the Madera Canal). The Corning and Tehama-Colusa Canals serve an area on the westside of the Sacramento Valley. Other water supplies are furnished to districts and water rights holders in the Sacramento Valley. American River water stored in Folsom Reservoir is used mainly for stream flow and Delta requirements, including CVP exports. More recently, the San Felipe Unit was added to serve coastal counties west of San Luis Reservoir. New Melones Reservoir would be serving an area on the eastern side of the San Joaquin Valley as well as providing downstream water quality and fishery flows. Operations in the Delta are coordinated with the SWP to meet water quality and other standards set by the State Water Resources Control Board, and more recently by federal fisheries agencies.

The CVP water deliveries to agricultural and urban users have been reduced by the passage of the CVPIA of 1992, which mandates changes in management of the Central Valley Project, particularly for the protection, restoration, and enhancement of fish and wildlife. Responsibility for implementing the 103 provisions of the Act is shared by Reclamation and USFWS. As a result, CVP contractors would undergo more frequent and severe shortages. In the short-term, CVP contractors relying on the Delta for all or a portion of their supplies face great uncertainty in terms of water supply reliability due to the uncertain outcome of a number of actions currently being undertaken to protect aquatic species in the Delta. Until solutions to complex Delta problems are identified and put into place, many will experience more frequent and severe water supply shortages. For example, in 1993, an above-normal runoff year, environmental restrictions limited CVP deliveries to Westlands Water District to only 60 percent of contracted supply. Across the entire CVP, the CVPIA reallocates 800,000 acre-feet of water for fisheries in Central Valley streams, 200,000 acre-feet for wildlife refuges in the Central Valley, and about 120,000 acre-feet of increased flow for the Trinity River.

State Water Project Operations

The SWP is a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants. It extends for more than 600 miles across two-thirds of the state of California. The SWP's main purpose is to store water during wet periods and distribute it to areas of need across the state. The state has contracts to supply up to 4.2 million acre-feet of water annually to 29 public agencies.

The SWP's major components include the multipurpose Oroville Dam and Reservoir on the Feather River, the Edmund G. Brown California Aqueduct, South Bay Aqueduct, North Bay Aqueduct, and a portion of San Luis Reservoir. Contracts were signed for an eventual delivery of 4.23 million acre-feet. Generally, San Joaquin Valley use of SWP supply has been near full contract amounts since about 1980 (except during very wet years and during deficient-supply years), whereas Southern California use has only built up to about 60 percent of full entitlement.

Of the contracted amounts, about 2.5 million acre-feet of water is destined for south of the Tehachapis Mountains, nearly 1.36 million acre-feet to the San Joaquin Valley, and the remaining 0.37 million acre-feet to the San Francisco Bay and Central Coast regions and the Feather River area.

SWP contractors face the same challenges with delta reliability issues as the CVP contractors. SWP contractors relying on the Delta for all or a portion of their supplies, in the short-term, face great uncertainty in terms of water supply reliability due to the uncertain outcome of a number of actions currently being undertaken to protect aquatic species in the Delta. Until solutions to complex Delta problems are identified and resolved, many will experience more frequent and severe water supply shortages.

The SWP is currently unable to meet contractual obligations to its long-term contractors on a reliable basis, and it is predicted that shortages will continue in the future. There are two causes for these shortages: (1) construction of the SWP was never completed, and (2) environmental regulations limit Delta export capability, hampering the development of additional water supply.

Eastside CVP Contractor Operations

Eastside CVP contractors receive San Joaquin River water, which is impounded and stored in Millerton Lake located approximately 25 miles northeast of Fresno. Millerton Lake has a maximum storage capacity of 520,000 acre-feet of water, and delivers an average annual yield of 1,500,000 acre-feet. From Millerton Lake, water is conveyed to the eastside contractors through the Friant-Kern Canal. The Friant-Kern Canal carries water south to Fresno, Tulare, and Kern Counties. In addition, the Madera Canal conveys water from Millerton Lake north to Madera County.

The runoff from the San Joaquin River watershed is at times very erratic, and because of this, all eastside CVP contractors share in the available supply of water, including shortages, in a ratio based on their respective contract allocations. The eastside contracts receive two classes of water:

- **Class 1** water is defined as that supply of water stored at Friant Dam which would be available for delivery from the Friant-Kern and Madera Canals as a dependable water supply during each irrigation season.

- **Class 2** water is that supply of nonstorable water which becomes available in addition to the supply of Class 1 water and which, because of its uncertainty as to availability and time of occurrence, would not be dependable in character and would be furnished only if and when water is available as determined by the United States.

Due to the erratic nature of the runoff from the San Joaquin River watershed, eastside CVP contractors may have an immediate need to transfer and exchange water, depending on seasonal conditions. This water is currently transferred/exchanged among the eastside contractors, and does not necessarily go to the maximum beneficial use.

Kern County Water Agency

The KCWA was created in 1961 by a special act of the state legislature and approved by county voters. Its mission was to secure an adequate water supply for Kern County by serving as the local contracting entity for the SWP. KCWA obtains water from several sources (Table 3-1). In addition, it was granted powers to participate in a wide scope of water management duties including management of water quality, flood waters, and ground water. SWP deliveries began in 1968, however, since 1987, KCWA and its Member Units have been faced with extreme variability in supply on both local and statewide fronts due to drought, increasing environmental regulations in the Delta, and expanding demands on the state's water system. Under these conditions, making the best possible use of the existing water supply and protecting those water supplies from external threats is becoming increasingly important.

Table 3-1
Sources of Water for Kern County Water Agency

Source	Percent
Kern River	22
State Water SWP	23
Central Valley CVP	11
Groundwater	43
Total	**99**

Source: Kern County Water Agency

The SWP water is conveyed to Kern County through the California Aqueduct. KCWA owns and operates the 22 mile long Cross Valley Canal which lifts water from the aqueduct to the KCWA service area. KCWA is the second largest participant in the SWP, holding a yearly maximum entitlement of 1,112,730 acre-feet of water. Of that amount, 134,000 acre-feet are allocated to municipal and industrial use, and the remaining 978,730 acre-feet used for irrigation. Members of KCWA also hold interim contracts for CVP water.

The Long-term Groundwater Recharge and Recovery SWP sponsored by KCWA allows the KCWA to receive water in wet years from a wide variety of sources including the SWP, CVP, Kern River, and floodwater from sources outside Kern County. This water can be used for recharge using KCWA facilities and stored in the ground for use in subsequent dry years. Stored water can be pumped for local use, or exchange/transferred for other surface water, or conveyed to KCWA member units.

Westside CVP Contractors

The supply of CVP water for contractors located on the westside of the San Joaquin Valley and in the San Felipe Division (westside contractors) is pumped from the Sacramento-San Joaquin River Delta. Due to recent water quality, environmental, and legislative requirements affecting the Delta, the supply of water to the westside CVP contractors is predicted to be insufficient for current needs. Urban and agricultural conservation practices are being implemented to reduce overall demand. The balance is made up with pumping groundwater from a severely over-drafted aquifer and voluntary redistribution of surface water.

3.1.2 Groundwater

3.1.2.1 Regional Setting

The southern two-thirds of the Central Valley regional aquifer system, which covers over 13,500 square miles extending from just south of the Delta to just south of Bakersfield, is referred to as the San Joaquin Valley Basin. Much of the western portion of this area is underlain by the Corcoran Clay Member that divides the groundwater system into two major aquifers: a confined aquifer below the clay and a semi-confined aquifer above the clay. Aquifer recharge to the semi-confined upper aquifer historically occurred from stream seepage, deep percolation of rainfall, and subsurface inflow along basin boundaries.

Groundwater in the San Joaquin Valley has been heavily developed by pumping, largely for crop irrigation. Pumping has caused depressions to form due to subsidence and has altered regional groundwater flow patterns, recharge, and discharge. Annual groundwater pumping in the San Joaquin River Region exceeds recent estimates of perennial yield by approximately 200,000 acre-feet

(Department of Water Resources 1993a). This overdraft condition exists, to some degree, in all the subbasins of the region.

As a result of land subsidence, increased pumping lifts, and water quality limitations, surface water was imported to the western valley to decrease pumpage. Beginning in 1967, surface water imported via the California Aqueduct began to replace groundwater as the primary source of irrigation supply in the area south of Mendota. The availability of surface water led to an increase in the total quantity of water applied, whereas the quantity of water removed from the system by wells decreased. The marked decrease in pumpage has allowed a recovery in hydraulic head. The rise in the potentiometric surface from 1967 to 1984 was nearly one-half the drawdown that occurred from predevelopment conditions to 1967. The potentiometric surface is defined as the level that water from the confined aquifer would rise to in a tightly cased well completed in the confined aquifer. Agricultural development also has affected the semiconfined zone. Increased rates of recharge resulting from percolation of irrigation water, combined with the rapid post-1967 decrease in pumpage, caused a rise in the altitude of the water table over much of the western valley (Belitz and Heimes 1990).

Vertical groundwater flow is substantial in the western San Joaquin Valley. According to Belitz and Heimes (1990), the combined result of pumping from below the Corcoran Clay and percolation of irrigation water from above the water table has been the development of a large downward flow gradient in the semi-confined aquifer and a groundwater flow divide in the western part of the valley.

3.1.3 Water Quality

3.1.3.1 Surface Water

Regional Water Quality

Surface water quality in the San Joaquin River Basin is affected by several factors, including natural runoff, agricultural return flows, biostimulation, construction, logging, grazing, operations of flow regulating facilities, urbanization, and recreation. In addition, irrigated crops grown in the western portion of the San Joaquin Valley have accelerated the leaching of minerals from soils, altering water quality conditions in the San Joaquin River system.

Water that would be transferred/exchanged under the Proposed Action would be conveyed in the California Aqueduct and the Friant-Kern Canal. Water quality in the California Aqueduct and the Friant-Kern Canal meets all applicable water quality regulations and guidance. Tables 3-2 and 3-3 present water quality data for the California Aqueduct and the Friant-Kern Canal, respectively.

Table 3-2
California Aqueduct O'Neill FB Outlet (Check 13) Water Quality 12/98 to 12/99

Constituent	Units	Median	Minimum	Maximum	# of Samples
Alkalinity	mg/L	74	54	83	13
Arsenic	mg/L	0.002	0.001	0.001	13
Bicarbonate	mg/L	nr	nr	nr	0
Boron	mg/L	0.2	0.1	0.3	13
Bromide	mg/L	0.18	0.08	0.21	13
Calcium	mg/L	19	15	26	13
Carbon- Total Organic	mg/L	2.8	2.5	4	13
Carbonate	mg/L	nr	nr	nr	0
Chloride	mg/L	56	31	65	13
Chromium	mg/L	0.005	0.005	0.005	13
Copper	mg/L	0.002	0.002	0.002	13
Fluoride	mg/L	0.1	0.01	0.1	13
Hardness	mg/L	93	70	118	13
Iron	mg/L	0.008	0.005	0.016	13
Lead	mg/L	<0.001	<0.001	<0.001	13
Magnesium	mg/L	11	8	13	13
Manganese	mg/L	0.007	0.005	0.015	13
Nitrate	mg/L	0	0	0	13
pH	SU	nr	nr	nr	0
Potassium	mg/L	nr	nr	nr	0
Selenium	µg/L	<1	<1	<1	13
Sodium	mg/L	45	28	54	13
Specific Conductance	µS/cm	418	272	534	13
Sulfate	mg/L	39	20	66	13
Temperature	degrees C	nr	nr	nr	0
Total Dissolved Solids	mg/L	230	158	295	13
Trihalomethane Formation Potential	µg/L	399	292	516	13
Turbidity	NTU	8.1	0.005	7	13
Zinc	mg/L	0.466	<0.005	6	13

Notes: µg/L - Micrograms per liter.
mg/L - Milligrams per liter.
µS/cm - MicroSiemens per centimeter.
ND - Not detected.
NR - Not reported.
NTU - Nephelometric turbidity unit.
SU - Siemens unit.

Source: California Department of Water Resources 2000.

Table 3-3
Friant Kern Canal Mile Point 122.05 to 0.5 mile
Below Delano Reservoir Water Quality - 4/57 to 9/98

Constituent	Units	Median	Minimum	Maximum	# of Samples
Alkalinity	mg/L	nr	nr	nr	0
Arsenic	mg/L	nr	nr	nr	0
Bicarbonate	mg/L	18	3	32	37
Boron	mg/L	0.12	0.05	0.19	2
Bromide	mg/L	nr	nr	nr	0
Calcium	mg/L	5.0	1.7	9.6	37
Carbon- Total Organic	mg/L	nr	nr	nr	0
Carbonate	mg/L	0.01	0	0.1	6
Chloride	mg/L	4.7	0.5	14.9	37
Chromium	mg/L	nr	nr	nr	0
Copper	mg/L	nr	nr	nr	0
Fluoride	mg/L	nr	nr	nr	0
Hardness	mg/L	nr	nr	nr	0
Iron	mg/L	nr	nr	nr	0
Lead	mg/L	nr	nr	nr	0
Magnesium	mg/L	1.0	0.1	2.2	35
Manganese	mg/L	nr	nr	nr	0
Nitrate	mg/L	1.0	0.2	5.8	20
pH	SU	7.0	6	7.6	36
Potassium	mg/L	1.0	0	2.7	28
Selenium	µg/L	nr	nr	nr	0
Sodium	mg/L	3.9	1.5	8.3	37
Specific Conductance	µS/cm	nr	nr	nr	0
Sulfate	mg/L	4.3	0.2	16	36
Temperature	degrees C	58	29	78	32
Total Dissolved Solids	mg/L	46	24	109	37
Trihalomethane Formation Potential	µg/L	nr	nr	nr	0
Turbidity	NTU	nr	nr	nr	0
Zinc	mg/L	nr	nr	nr	0

Notes: µg/L - Micrograms per liter.
mg/L - Milligrams per liter.
µS/cm - MicroSiemens per centimeter.
ND - Not detected.
NR - Not reported.
NTU - Nephelometric turbidity unit.
SU - Siemens unit.

Source: California Department of Water Resources 2000.

3.1.3.2 Groundwater

Groundwater zones commonly used along portions of the western margin of the valley have high concentrations of total dissolved solids, ranging from 500 mg/L to greater than 2,000 mg/L (Bertoldi *et al.* 1991). The concentrations in excess of 2,000 mg/L commonly occur above the Corcoran Clay layer. These high levels have impaired groundwater for irrigation and municipal uses in the western portion of San Joaquin County. Inadequate drainage and accumulating salts have been persistent problems along the westside and in parts of the east side of the San Joaquin River Region for more than a century. In some portions of the San Joaquin River Region, natural drainage conditions are inadequate to remove the deep percolation to the water table. This occurs because vertical conductivity is low and therefore, limits downward drainage of infiltrated water (U.S. Bureau of Reclamation 2000).

3.2 BIOLOGICAL RESOURCES

3.2.1 Regional Setting

Historically, the SJV floor contained a diverse and productive patchwork of aquatic, wetland, riparian forest, and surrounding terrestrial habitats that supported abundant populations of resident and migratory species of wildlife. Huge herds of pronghorn (*Antilocapridae americana*), tule elk (*Cervus canadensis*), and mule deer (*Odocoileus hemionus*) grazed the prairies, and large flocks of waterfowl occurred in the extensive wetlands. Such rich biological diversity and productivity supported the densest nonagricultural population of Native Americans in North America (Cook 1955; Kroeber 1961; Latta 1949). The major natural plant communities in the San Joaquin Valley included grasslands, vernal pools, marshes, and riparian forests. Several grassland communities included: nonnative grassland, pine bluegrass grassland, relictual interior dune grassland, valley needlegrass grassland, and valley sacaton grassland (USFWS 1998). Valley salt scrub, dominated by Valley saltbush (*Atriplex polycarpa*), occupied the valley floor in sandy, non-alkaline soils.

Upland habitats in SJV shrublands were dominated by shrubs less than six feet tall. Grasses and forbs typical of grassland communities covered the ground between and under shrubs. Shrubs occurred in alkali sinks, on alluvial fans, on dune remnants, in riparian areas and in arid uplands. Alkali playas were often interspersed within this habitat type. The dominant plant species was iodine bush (*Allenrolfea occidentalis*). Other plants were bush seepweed (*Suaeda moquinii*), alkali heath (*Frankenia salina*), saltgrass (*Distichlis spicata*), desert isocoma, jackass clover (*Wislizenia refracta refracta*), and goldfields (*Lasthenia sp.*). Located near wetlands, these upland habitats provided foraging habitat for waterfowl and shorebirds during wet months. In summer months, if the ephemeral pools remained, black-necked stilts (*Himantopus mexicanus*) and American avocets (*Recurvirostra americana)* could find foraging and nesting habitat. Other species of birds utilizing this habitat were common raven (*Corvus corax*), western meadowlark (*Sturnella neglecta*), horned lark (*Eremophila alpestris*), American pipit (*Anthus rubescens*), lesser nighthawk (*Chordeiles acutipennis*), and sage sparrow (*Amphispiza belli*). Mammals in the valley sink scrub included blacktail jackrabbit (*Lepus californicus*), Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*), and San Joaquin kit fox (*Vulpes macrotis mutica*). Reptilian species included blunt-nosed leopard lizard (*Gambelia silus*), side-blotched lizard (*Uta stansburiana*), western whiptail *(Cnemidophorus tigris*), kingsnake (*Lampropeltis getulus*), and western rattlesnake (*Crotalus viridis*) (U.S. Bureau of Reclamation 2000).

Today, land uses in the SJV, including agricultural, residential, and municipal and industrial uses, have converted land from native habitats to cultivated fields and grazing, homes, water impoundments, flood control structures, and other developments. Conversion of native terrestrial habitats to agricultural uses and urbanization has dramatically reduced populations of upland wildlife species. Draining once extensive lakes, diversions, water storage projects, and interbasin transfers has drastically reduced instream flows in SJV streams. Declining water quality due to contamination by municipal, industrial, and agricultural wastes and other human activities has taken a substantial toll on the populations of aquatic and wetland wildlife of SJV. Most of the species that occurred historically in the SJV remain in these habitat areas although at lower than historical numbers. Because of the reduction in the acres of habitat available to these species, remnants of habitats such as wetlands, riparian forests, valley oak savannahs, and San Joaquin saltbush are increasingly valuable.

3.2.2 Regulatory Setting

The applicable regulatory act regarding biological resources is the Endangered Species Act (ESA). The objective of the ESA is to provide a means to conserve the ecosystem upon which endangered and threatened species depend and to provide a program for the conservation of such species. Major goals of the ESA are to prevent extinctions, reverse declines, stabilize populations, prevent further habitat degradation, and restore habitat necessary for recovery.

Sixty-five endangered, threatened, proposed, candidate, rare, species of concern, and/or species of special concern that may occur in the SJV (Table 3-4) are considered special status species in the project area. For purposes of this document, species that are federal or California state endangered, threatened, proposed, candidate, rare, or a species of special concern are referred to collectively as "special status species." Complete species accounts may be found in the Recovery Plan for the Upland Species of the San Joaquin Valley, California (USFWS 1998a). Section 7 regulations of the ESA do not require federal-classified species of concern and/or state-classified species of special concern to be addressed through section 7 consultation; however, it is recommended. These species are not generally addressed because of the sheer number of species which would have to be considered; however, if a species is classified by either the federal or state governments as endangered, threatened, proposed, candidate, or rare, then it was included in the list.

3.2.3 Biological Resources

Several plant communities are found within the project area. The descriptions below are representative of the natural communities and associated wildlife, including special status species (see Table 3-4 for species status) that are found in the project area. Several species that once occurred in SJV no longer occur, and others are listed as species of special concern (i.e., threatened or endangered) by federal or state governments (Brown and Moyle 1992). Table 3-4 provides a list of federal and state special status species within the region.

Grasslands

Grasslands occur on the valley floor and surrounding foothills of the Central Valley and were originally dominated by native perennial grasses such as needlegrass *(Nassella pulchra*) and alkali sacaton *(Sporobolus airoide*s). Currently most grasslands in the area are dominated by introduced annual grasses of Mediterranean origin and a mixture of native and introduced forbs.

Wildlife species that typically occur in this habitat include western fence lizard (*Sceloporus occidentalis*), common garter snake (*Thamnophis sirtalis*), western rattlesnake, black tailed jackrabbit, California ground squirrel (*Citellus beecheyi*), Botta's pocket gopher (*Thomomys bottae*), western harvest mouse (*Reithrodontomys megalotis*), badger (*Taxidea taxus*), coyote (*Canis latrans*), burrowing owl (*Athene cinicularia)*, horned lark (*Eremophila alpestris)*, western meadowlark (*Sturnella neglecta)*, and foraging habitat for turkey vulture (*Cathartes aura)*, northern harrier (*Circus cyaneus)*, American kestrel (*Falco sparverius)*, white tailed kite (*Elanus leucurus)*, and prairie falcon (*Falco mexicanus)* (California Resources Agency 1988).

Special status plant species occur in isolated populations within grassland habitat including Bakersfield cactus (*Opuntia basilaris* var. *treleasei*), California jewelflower (*Caulanthus californicus*), Hartweg's golden sunburst (*Pseudobahia bahiifolia*), Hoover's woolly-star (*Eriastrum hooveri*), and San Joaquin wooly-threads (*Lembertia congdonii*) (California Resources Agency 1988).

Table 3-4
Federal and State Special Status Species in the SJV

Species Common and Scientific Name	Federal Status	California State Status
Mammals		
Giant kangaroo rat, *Dipodomys ingens*	Endangered	Endangered
Fresno kangaroo rat, *Dipodomys nitratoides exilis*	Endangered	Endangered
Tipton kangaroo rat, *Dipodomys nitratoides nitratoides*	Endangered	Endangered
San Joaquin kit fox, *Vulpes macrotis mutica*	Endangered	Threatened
California bighorn sheep, *Ovis canadensis californiana*	Endangered	Endangered
San Joaquin Valley woodrat, *Neotoma fuscipes riparia*	Proposed Endangered	Species of special concern[1]
Nelson's (San Joaquin) antelope (ground) squirrel, *Ammospermophilus nelsoni*	None	Threatened
California wolverine, *Gulo gulo luteus*	None	Threatened
Sierra Nevada red fox, *Vulpes vulpes necator*	None	Threatened
Birds		
American peregrine falcon, *Falco peregrinus anatum*	Delisted	Endangered
Aleutian Canada goose, *Branta canadensis leucopareia*	Threatened	None
California condor, *Gymnogyps californianus*	Endangered	Endangered
Bald eagle, *Haliaeetus leucocephalus*	Proposed for Delisting	Endangered
Mountain plover, *Charadrius montanus*	Proposed Threatened	Species of special concern
Swainson's hawk, *Buteo swainsoni*	None	Threatened
Western yellow billed cuckoo, *Coccyzus americanus occidentalis*	None	Endangered
Western snowy plover, *Charadrius alexandrinus nivosus*	Threatened	Species of special concern
Willow flycatcher, *Empidonax traillii*	None	Endangered
Bank swallow, *Riparia riparia*	None	Threatened
Great gray owl, *Strix nebulosa* Northern spotted owl, *Strix occcidentalis caurina*	None Threatened	Endangered None
Reptiles		
Blunt-nosed leopard lizard, *Gambelia (=Crotaphytus) silus*	Endangered	Endangered
Giant garter snake, *Thamnophis gigas*	Threatened	Threatened
Amphibians		
California red-legged frog, *Rana aurora draytonii*	Threatened	Species of special concern
California tiger salamander, *Ambystoma californiense*	Candidate	Species of special concern

Table 3-4 (continued)
Federal and State Special Status Species in the SJV

Species Common and Scientific Name	Federal Status	California State Status
Fish		
Delta smelt, *Hypomesus transpacificus*	Threatened	Threatened
Lahontan cutthroat trout, *Oncorhynchus (=Salmo) clarki henshawi*	Threatened	None
Paiute cutthroat trout, *Oncorhynchus (=Salmo) clarki seleniris*	Threatened	None
Sacramento splittail, *Pogonichthys macrolepidotus*	Threatened	Species of special concern
Invertebrates		
Kern primrose sphinx moth, *Euproserpinus euterpe*	Threatened	None
Longhorn fairy shrimp, *Branchinecta longiantenna*	Endangered	None
Conservancy fairy shrimp, *Branchinecta conservatio*	Endangered	None
Vernal pool tadpole shrimp, *Lepidurus packardi*	Endangered	None
Vernal pool fairy shrimp, *Branchinecta lynchi*	Threatened	None
Delta green ground beetle, *Elaphrus viridis*	Threatened	None
Valley elderberry longhorn beetle, *Desmocerus californicus dimorphus*	Threatened	None
Plants		
Bakersfield cactus, *Opuntia basilaris, var. treleasei*	Endangered	Endangered
Large-flowered fiddleneck, *Amsinckia grandiflora*	Endangered	Endangered
Monterey Pine, *Pinus radiata*	Species of Concern	None
Chinese Camp brodiaea, *Brodiaea pallida*	Threatened	Endangered
Keck's Checker mallow, *Sidalcea keckii*	Proposed Endangered	None
Contra Costa goldfieds, *Lasthenia conjugens*	Endangered	None
California vervain, *Verbena californica*	Threatened	Threatened
Springville clarkia, *Clarkia springvillensis*	Threatened	Endangered
Colusa grass, *Neostapfia colusana*	Threatened	Endangered
Fleshy owl's-clover, *Castilleja campestris* ssp. *succulenta*	Threatened	Endangered
Slender Orcutt grass, *Orcuttia tenuis*	Threatened	Endangered
Greene's Orcutt grass, *Tuctoria greenei*	Endangered	Rare
Crampton's Tuctoria, *Tuctoria mucronata*	Endangered	Endangered
Hoover's spurge, *Chamaesyce hooveri*	Threatened	None
Marsh sandwort, *Arenaria paludicola*	Endangered	Endangered
California jewelflower, *Caulanthus californicus*	Endangered	Endangered
Palmate-bracted bird's beak, *Cordylanthus palmatus*	Endangered	Endangered
San Joaquin woolly-threads, *Lembertia congdonii*	Endangered	None
San Benito evening-primrose, *Camissonia benetensis*	Threatened	None
Hoover's woolly-star (=eriastrum), *Eriastrum hooveri*	Threatened	None

Table 3-4 (continued)
Federal and State Special Status Species in the SJV

Species Common and Scientific Name	Federal Status	California State Status
Mariposa pussypaws, *Calyptridium pulchellum*	Threatened	None
San Joaquin Valley Orcutt grass, *Orcuttia inaequalis*	Threatened	Endangered
Hairy Orcutt grass, *Orcuttia pilosa*	Endangered	Endangered
Hartweg's golden sunburst, *Pseudobahia bahiifolia*	Endangered	Endangered
San Joaquin adobe sunburst, *Pseudobahia peirsonii*	Threatened	Endangered
Carpenteria (=Tree-anemone), *Carpenteria californica*	Species of Concern	Threatened
Tompkin's sedge, *Carex tompkinsii*	None	Rare
Boggs Lake Hedge-hyssop, *Gratiola heterosepala*	None	Endangered
Congdon's lewisia, *Lewisia congdonii*	None	Rare

Notes: [1] Federal-classified species of concern and/or state-classified species of special concern are not generally addressed in an environmental assessment or Endangered Species Act section 7 consultation due to the sheer number of species which would have to be considered; however, if a species was classified by either the federal or state governments as endangered, threatened, proposed, candidate, or rare, then it was included in the list.

FEDERAL STATUS DEFINITIONS:

Endangered: Species that is in danger of extinction throughout all or a significant portion of its range.
Threatened: Species that is likely to become endangered within the foreseeable future.
Proposed: Species that has been proposed in the *Federal Register* to be listed as endangered or threatened.
Candidate: Species for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.
Species of concern: Species for which existing information indicated may warrant listing, but for which substantial biological information to support a proposed rule is lacking.
None: Not listed by the Federal Government.

STATE STATUS DEFINITIONS:

Endangered: A native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease.
Threatened: A native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts required by chapter 1.5 of the California Fish and Game Code.
Rare: A species, subspecies, or variety is rare when, although not presently threatened with extinction, it is in such small numbers throughout its range that it may become endangered if its present environment worsens.
Candidate: A native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant that the commission has formally noticed as being under review by the department for addition to either the list of endangered species or the list of threatened species, or a species for which the commission has published a notice of proposed regulation to add the species to either list.
Species of special concern: Native species or subspecies that have become vulnerable to extinction because of declining population levels, limited ranges, or rarity. The goal is to prevent these animals from becoming endangered by addressing the issues of concern early enough to secure long-term viability for these species.
None: Not listed by the Federal or State Government.

Special status wildlife species including blunt-nosed leopard lizard, San Joaquin kit fox, giant kangaroo rat (*Dipodomys ingens*), Tipton kangaroo rat, and Fresno kangaroo rat (*Dipodomys nitratoides exilis*) occur in arid grasslands in the San Joaquin and Tulare Basins. Other special status species require microhabitats within the more general grassland habitat designation. The San Joaquin adobe sunburst (*Pseudobahia peirsonii*) is restricted to grasslands on adobe clay soils in the San Joaquin Valley. The Kern primrose sphinx moth (*Euproserpinus euterpe*) occurs locally in agricultural fields and grasslands in the Walker Basin in Kern County. The large-flowered fiddleneck (*Amsinckia grandiflora*) occurs in grasslands on a few sites in Alameda, San Joaquin, and Contra Costa Counties. Reintroduced California Condors (*Gymnogyps californianus*) (in the southern San Joaquin Valley) range widely and may forage in grassland habitat (U.S. Bureau of Reclamation 2000). Less than one percent of remaining grassland areas in the Central Valley contain enough native grass species to be labeled either valley sacaton or valley needlegrass grasslands (Davis et al 1998). Additional information on this habitat can be found in the San Joaquin Valley Native Species Recovery Plan (USFWS 1998a).

Oak Woodland

Several different types of oak woodland occur on the foothills and riparian corridors of the Central Valley and central coast regions of California. Oak woodlands in the project area include stands dominated by: valley oak *(Quercus lobata*), mostly along rivers and streams on the valley floor and lower foothills; blue oak *(Q. douglasii*) and gray pine *(Pinus sabiniana*), at low to middle elevations in foothills of the Sierra Nevada and Coast Ranges; coast live oak woodland *(Q. agrifolia*) in valleys and hills of the Coast Ranges; and canyon live oak *(Q. chrysolepis*) and interior live oak *(Q. wislizenii*), near reservoirs. Transitional communities of mixed oaks, other hardwoods, pine, and chaparral occur among many of these woodland types (Griffin 1977). These oak woodlands correspond to the valley oak savanna, Oregon oak forest, mixed hardwood forest, and blue oak pine forest, and can be considered to comprise a "cismontane woodland" category (USFWS 1998a).

Wildlife found in oak woodland habitats includes California quail (*Callipepla californica*), plain titmouse (*Parus inornatus*), Western scrub jay (*Aphelocoma californica*), rufous sided towhee (*Pipilio erythrophthalmus clementae*), Bewick's wren (*Thryomanes bewickii*), bushtit (*Psaltriparus minimus*), acorn woodpecker (*Melanerpes formicivorus*), western gray squirrel (*Sciurus griseus*), and mule deer, among others (California Resources Agency 1988).

Special status species associated with oak woodland include California condor, California red-legged frog (*Rana aurora draytoni*), and California tiger salamander (*Ambystoma californiense*). Reintroduced California condors (in the southern San Joaquin Valley) range widely and may occur in oak woodland habitat. California red-legged frogs occur in oak woodland in foothills of the Coast Range and isolated drainages in the Sierra Nevada. California tiger salamanders occur in oak woodland at the fringes of the Central Valley and in the Coast Ranges. The frogs and salamanders live in burrows of these woodlands during dry parts of the year which are essential to their survival (U.S. Bureau of Reclamation 2000).

Evergreen Hardwood and Coniferous Forests

Coniferous and evergreen hardwood forests generally occur at higher elevations in the Sierra Nevada and Coast Ranges, on the margins of the Central Valley. This category comprises several forest types. Montane forests in the Coast Ranges and Sierra Nevada are dominated by a variety of conifers including ponderosa pine *(Pinus ponderos*a), Jeffrey pine *(P. jeffrey*i), Douglas-fir *(Pseudotsuga menziesii*), red fir *(Abies magnifica*), and white fir *(A. concolor*). In the Coast Ranges stands may be dominated by evergreen hardwoods such as madrone *(Arbutus menziesii*), tanoak *(Lithocarpus densiflorus*), and bay laurel *(Umbellularia californica*). Dry regions support woodlands and savannas dominated by pinyon pine *(P. monophylla*) and juniper *(Juniperus californica*). On drier sites, stands may be dominated by cypress *(Cupressus* spp.) and fire-dependent species such as Monterey pine *(P. radiata*) and knobcone pine *(P. attenuata*).

Wildlife species that occur in this habitat include ensatina (*Ensatina eschscholtzii*), California slender salamander (*Batrachoseps attenuatus*), western fence lizard, sagebrush lizard (*Sceloporus graciosus*), western rattlesnake, California mountain king snake (*Lampropeltis zonata*), sharp-tailed snake (*Contia tenuis*), wild turkey (*Meleagris gallopavo)*, mountain quail (*Oreortyx pictus*), band-tailed pigeon (*Columba fasciata*), California ground squirrel (*Citellus beecheyi*), dusky-footed woodrat (*Neotoma* *fuscipes*), black bear (*Ursus americanus*), mule deer, and mountain lion (*Felis concolor*) among others (California Resources Agency 1988).

Listed species associated with coniferous and evergreen hardwood forests are California condor, bald eagle (*Haliaeetus leucocephalus*), and northern spotted owl (*Strix occcidentalis caurin*). The California condor and bald eagle may occur over wide areas and are not specifically limited to coniferous forest (U.S. Bureau of Reclamation 2000).

Chaparral

Dense thickets of chamise (*Adenostoma fasciculatum*), manzanita (*Arctostaphylos* spp.), ceanothus (*Ceanothus* spp.), scrub oak (*Quercus berberidifolia*), and other shrubs characterize chaparral habitats in the Coast Ranges. Chaparral occurs mostly on steep slopes and ridgetops that have thin soils and are hot and dry during the summer. Moister variants of chaparral habitat occur in gullies and on cooler, north facing slopes (Hanes 1977). Patches of serpentine, volcanic, and granitic soils occur sporadically along the western flanks of the Sierra Nevada.

Wildlife that typically occurs in this habitat include western fence lizard, western rattlesnake, brush rabbit (*Sylvilagus bachmani*), desert cottontail (*Sylvilagus auduboni*), California ground squirrel, dusky-footed woodrat, black bear, and mule deer, and mountain lion and others (California Resources Agency 1988).

Special-status species associated with this habitat are Chinese Camp brodiaea (*Brodiaea pallida*), Keck's checker-mallow (*Sidalcea keckii)*, Mariposa pussypaws (*Calyptridium pulchellum*) (granitic soils), Red Hills vervain (*Verbena californica*), and Springville clarkia (*Clarkia springvillensis*) (granitic soils). Both gabbro and serpentine soils strongly influence plant distributions because of nutrient imbalances and other characteristics that favor the growth of plants specifically adapted to these conditions (U.S. Bureau of Reclamation 2000).

Fire suppression and reduced fire frequency have caused changes in the structure and species composition of large areas of chaparral. Longer intervals between fires has led to an increase in later successional species and slow-maturing species, greater standing biomass and dry fuels, and larger, more intense fires. Where fire is less frequent, many chaparral species decline. Also, roads, agriculture, and urban development have fragmented the habitat of some species. Changes in fire frequency and fragmentation have contributed to the decline of several species. Urban development increases local fire suppression efforts as well as directly removing chaparral habitat. Urban development in the foothills of the western Sierra Nevada, through expansion of residential neighborhoods and road construction and maintenance, has destroyed or degraded numerous populations of listed plants (U.S. Bureau of Reclamation 2000).

Vernal Pool

Vernal pools are seasonal wetlands that are unique to the Mediterranean climate region of California and northwestern Baja California and are most abundant in the Central Valley. Many of the endangered plants and invertebrates that inhabit vernal pools have sporadic and disjunct distributions (i.e., they occur in relatively few pools at a given location and some of these locations are widely separated from each other). Vernal pools are distinguished by their hydrology and their relationship to adjacent habitat. The Mediterranean climate of the region results in most rain falling during the winter. On locally flat land the water tends to pool after each rainfall in small depressions on the land surface. Over time the soils where the wetting and drying continue year after year develop a layer below the surface that becomes resistant to water. In some soils a hardpan of mostly lime develops. In others there is a layer where clay particles have built up. The pools gather water that falls as rain over a small area of relatively flat land and then hold it at the surface until it evaporates during the summer, providing a unique habitat type. Most of these vernal pools are found on sites where the soil has been in place for thousands of years. Over thousands of years a group of species has developed adaptations to the annual wetting and drying cycle and the mineral content of the water in the pools. Other species near pools (particularly co-adapted pollinators) interact with the plants and animals found in the pools themselves. The area comprising the pools, the areas of catchment where the water gathers as rain falls, and the associated species found in the habitat near the pools form a unit that is referred to as a "vernal pool complex." Conservation of vernal pool species depends on maintaining the ecosystem functions of the entire complex.

Special status species associated with vernal pools include: California tiger salamander, Colusa grass (*Neostapfia colusana*), Conservancy fairy shrimp (*Branchinecta conservatio*), Contra Costa goldfields (*Lasthenia conjugens*), delta green ground beetle (*Elaphrus viridis*), fleshy owl's-clover (*Castilleja campestris* ssp. *succulenta*), Greene's Orcutt grass (*Tuctoria greenei*), hairy Orcutt grass (*Orcuttia pilosa*), Hoover's spurge (*Chamaesyce hooveri*), longhorn fairy shrimp (*Branchinecta longiantenna*), San Joaquin Valley orcutt grass (*Orcuttia inaequalis*), slender orcutt grass (*Orcuttia tenuis*), Solano grass (*Tuctoria mucronata*), vernal pool fairy shrimp (*Branchinecta lynchi*), and vernal pool tadpole shrimp (*Lepidurus packardi*). Most of these species are patchily distributed within the Sacramento and/or San Joaquin Valleys in vernal pool complexes. Vernal pools are scattered throughout grassland habitats. Vernal pools occurred historically at varying densities in the Central Valley, and the USFWS estimates that 60 to 85 percent of historical vernal pool habitat had been eliminated as of 1973 (U.S. Bureau of Reclamation 2000).

Freshwater Wetland

Freshwater wetlands are characterized by a specialized community of aquatic dependent plant species such as the common tule *(Scirpus acutus*), cattail *(Typha latifoli*a), sedges *(Carex* spp.), spike-rush *(Eleocharis* spp.) and rushes *(Juncus* spp.). The types of plants, types of soils, and inundation duration usually define wetlands. Wetland types in this category include deep and shallow freshwater marshes, wet meadows, seasonal wetlands, saturated freshwater flats, and vegetated shallows.

Large numbers of migratory, wintering, and breeding waterfowl, shorebirds, and wading birds use freshwater wetlands in the SJV. The most common waterfowl species include the northern pintail (*Anas acuta*), northern shoveler (*Anas clypeata*), mallard (*Anas platyrhynchos*), cinnamon teal (*Anas cyanoptera*), green-winged teal (*Anas crecca*), gadwall (*Anas strepera*), ruddy duck (*Oxyura jamaicensis*), and redhead duck (*Aythya americana*). Large numbers of eared grebes (*Podiceps nigricollis*), American coots (*Fulica americana*), American avocets, black-necked stilts, western snowy plovers (*Charadrius alexandrinus nivosus*), black-bellied plovers (*Pluvialis squatarola*), killdeer (*Charadrius vociferus*), greater (*Tringa melanoleuca*) and lesser yellowlegs (*Tringa flavipes*), long-billed dowitchers (*Limnodromus scolopaceus*), dunlins (*Calidris alpina*), least sandpipers (*Calidris minutilla*), western sandpipers (*Calidris mauri*), and Wilson's phalaropes (*Steganopus tricolor*) also use wetlands in the SJV. Shorebirds commonly nest on levees and wavebreaks at many ponds.

Special status species associated with freshwater wetlands are Aleutian Canada goose (*Branta canadensis leucopareia*), bald eagle (*Haliaeetus leucocephalus*), Buena Vista Lake shrew (*Sorex ornatus relictus*), California red-legged frog, California tiger salamander, giant garter snake (*Thamnophis gigas*), and marsh sandwort (*Arenaria paludicola*). The bald eagle occurs widely throughout the Central Valley. After severe declines due largely to pesticides such as DDT, its numbers have been increasing following new pesticide regulations. Ecosystem degradation in the Central Valley may limit the extent of their recovery in the Central Valley. Eagles use riparian and wetland habitats for resting and foraging. Recovery of bald eagles may be limited by availability of nest trees in riparian and woodland habitat and by declining wetland habitat. In addition, California red-legged frogs have been virtually extirpated from the floor of the Central Valley, despite their historic presence in the Central Valley in numbers large enough for commercial harvest. They currently remain only in foothills of the Coast Range and isolated drainages in the Sierra Nevada. The giant garter snake occurs in scattered populations from Butte County south to the northern San Joaquin Valley. The Aleutian Canada goose winters in restricted areas of the Sacramento and San Joaquin Valleys. The Buena Vista Lake shrew is restricted to remnant wetland areas near the Kern Lake Preserve and Kern National Wildlife Refuge (U.S. Bureau of Reclamation 2000).

The hydrology of many of the remaining wetlands in the SJV has been altered from seasonal to permanent inundation. This change has altered plant communities and facilitated the invasion of introduced aquatic predators such as bullfrogs (*Rana catesbeiana*), bass (*Paralabrax sp.*), and sunfish. These species compete with or prey upon several listed species, including California red-legged frogs and giant garter snakes (U.S. Bureau of Reclamation 2000).

Riverine, Riparian, and Floodplain

Riparian forests of the Central Valley are dominated by cottonwood *(Populus fremontii*) and willow *(Salix* spp.) near the rivers, with sycamore *(Platanus racemosa*), boxelder *(Acer negundo*), and valley oak *(Quercus lobata*) dominating the less frequently flooded higher terraces. Floodplain habitats above the riparian zone typically do not support wetland vegetation, but are hydrologically linked to rivers and riparian forests by periodic flooding that together can be considered an ecological unit. Streams historically flooded during the winter rainy season sometimes dry up partially or completely during summer droughts.

Wildlife found in these habitats include a variety of waterfowl, herons, shorebirds, belted kingfisher, and many insectivorous birds including swallows, swifts, and flycatchers. Common mammals include river otter (*Lontra canadensis*) and beaver (*Castor canadensis*). Several fish species migrate from ocean or estuary habitats to spawn in sloughs, tributary streams, or inundated floodplain, throughout the Central Valley. Sacramento splittail (*Pogonichthys macrolepidotus*), which migrate upstream to spawn in flooded riparian and floodplain vegetation, have also declined.

Special status species that occur in riparian habitats of the SJV include the Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), which has declined with the loss of habitat. Least Bell's vireos (*Vireo bellii pusillus*) have not nested anywhere in the Central Valley for several decades, and southwestern willow flycatchers (*Empidonax traillii extimus*) are restricted to the South Fork of the Kern River near Lake Isabella. The riparian woodrat (*Neotoma fuscipes riparia*) and riparian brush rabbit (*Sylvilagus bachmani riparius*) are now largely or completely restricted to Caswell State Park on the Stanislaus River, which is the largest remaining tract of riparian forest in the northern San Joaquin Valley. The California red-legged frog has now been extirpated from 75 percent of its historic range, mostly in the Central Valley. Riparian-dependent species include several of the most critically endangered species in the Central Valley (U.S. Bureau of Reclamation 2000).

Aquatic Resources of the San Joaquin River Corridor. The fish population of the San Joaquin River drainage is dominated today by more than 30 introduced fishes. Many of these have proliferated in habitats disturbed by water depletion and flow alteration; whereas, the native species generally decline in such conditions. Various species were introduced to California beginning in the 1800s to improve sport fisheries (e.g., bass, sunfish, catfish), to provide forage fish for game fish (e.g., threadfin shad), to control mosquitoes (e.g., mosquitofish), as bait fish (e.g., red shiner, fathead minnow, golden shiner), and some were accidentally introduced (e.g., logperch) (USFWS 1995).

The higher elevation coldwater streams now include brook (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*). Bluegill (*Lepomis macrochirus*) and largemouth bass (*Micropterus salmoides*) have largely replaced the large, mid-elevation stream fauna. The intermittent stream forms are threatened with habitat degradation from grazing and from proliferation of green sunfish and mosquitofish. In addition, native fishes of lakes, sloughs, and rivers of the SJV floor have almost entirely been replaced by sunfishes, catfishes, and carp (USFWS 1995). The thicktail chub (*Gila crassicauda*), an inhabitant of sloughs and lakes, is believed extinct, and the Sacramento perch (*Archoplites interruptus)* is extirpated from its native range and rarely occurs in some farm ponds (USFWS 1991).

The San Joaquin River historically supported both spring and fall runs of chinook salmon (*Oncorhynchus tshawytscha*). The spring run was once the most abundant salmon run in the San Joaquin drainage (runs exceeded 100,000 fish annually; USFWS 1991). However, due to curtailment of spring flows by Friant Dam operations and lack of adequate water temperatures for passage and spawning, this fish has been extirpated from the mainstem San Joaquin River (USFWS 1991). Fall-run chinook salmon can only gain access to the upper mainstem San Joaquin (i.e., below Friant Dam) in wet years (U.S. Bureau of Reclamation 2000).

3.3 CULTURAL RESOURCES

Cultural resources are prehistoric and historic sites, structures, districts, artifacts, or any other physical evidence of human activity considered important to a culture, subculture, or community for scientific, traditional, religious, or any other reason. There are three elements that describe cultural resources. Prehistoric resources, the first element, are physical properties resulting from human activities that pre-date written records and are generally identified as isolated artifacts or sites. Historic resources, the second element, include physical properties and architectural structures originating since the introduction of written records. These resources have important research potential because of their association with historical people or events, or have distinctive architectural styles. Native American resources, the third element, are sites, areas, and materials that may be historic or prehistoric and are important for religious or traditional reasons.

3.3.1 Prehistoric Resources

The project area has a long and complex cultural history with distinct regional patterns that extend back more than 11,000 years before present (B.P.). The first generally agreed on evidence for the presence of prehistoric peoples in the study area is represented by the distinctive fluted spear points called “Clovis” points, found on the margins of extinct lakes in the San Joaquin Valley. Based on information obtained from sites outside the project area, the ancient hunters who used these spear points existed only between 11,200 and 10,900 B.P. (U.S. Bureau of Reclamation 2000).

This span of time is often called the Clovis Period. Most researchers believe the Clovis Period was followed by another widespread complex, although the indicative artifacts consist of stemmed spear points rather than the fluted points that typify the Clovis Period. This poorly defined early cultural tradition is best known from a small number of sites in the San Joaquin Valley and the Sierra Nevada foothills and is thought to date 8,000 to 10,000 B.P. Approximately 8,000 years ago, many California cultures shifted the focus of their subsistence strategies from hunting to seed gathering, as evidenced by the increase in food-grinding implements found in archeological sites dating to this period. Recent studies suggest that this cultural pattern is more widespread than originally described and is found throughout the study area. Radiocarbon dates associated with this period vary between 8,000 and 2,000 B.P., and cluster in the 6,000 to 4,000 B.P. range (Basgall and True 1985).

Cultural patterns, as reflected in the archeological record and, particularly, specialized subsistence practices, became better defined within the last 3,000 years. The archeological record becomes more complex as specialized adaptations to locally available resources were developed and populations expanded. Many sites dated to this time period contain mortars and pestles or are associated with bedrock mortars, implying that the occupants exploited acorns intensively. The range of subsistence resources increased and exchange systems expanded significantly from the previous period. Along the coast and in the Central Valley, archeological evidence of social stratification and craft specialization is indicated by well-made artifacts, such as charmstones and beads, which were often found with burials (U.S. Bureau of Reclamation 2000).

3.3.2 Historic Resources

Historically, the SJV floor contained a diverse and productive patchwork of aquatic, wetland, riparian forest, and surrounding terrestrial habitats that supported abundant populations of resident and migratory species of wildlife. Huge herds of pronghorn, tule elk, and mule deer grazed the prairies, and large flocks of wildfowl occurred in the extensive wetlands. Such rich biological diversity and productivity supported one of the densest non-agricultural populations of Native Americans in North America (Cook 1955; Krober 1961; Latta 1949). In the foothills, the numerous prehistoric sites reflect a variety of occupational and resource procurement activities (U.S. Bureau of Reclamation 2000).

The arrival of nonnative peoples into the region had drastic affects on native populations. Introduced diseases wiped out entire villages and the overall native population was reduced by 60 percent or more of their late prehistoric levels. The Spanish made a number of incursions into the area to recover mission runaways and stolen horses, but no permanent settlements were established (U.S. Bureau of Reclamation 2000).

The area was sparsely populated by Euro-Americans during the Mexican Period (1821–1846) but large herds of semi-wild horses and cattle were common. Mexican expeditions were mostly military ones sent to control the Yokuts and get revenge for their raids on Mexican resources. Two Mexican land grants were made: one between the Kings River and Cross Creek, the other on the north bank of the Kings River. Only the latter, Manuel Castro's Rancho Laguna de Tache, was occupied (Preston 1981).

The Gold Rush of 1849 changed the region markedly. The need for meat led to the establishment of cattle ranches and market hunting of tule elk and waterfowl. The Tulare Lake basin became a major stock raising area serving the mining towns of the Sierras and cities of Stockton, Sacramento, and San Francisco. Hogs were taken to the Central Valley to root in the summertime and driven into the foothills in the fall to fatten up on oak acorns. The latter had a direct negative impact on one of the Yokuts main food resources. As the Gold Rush faded, the miners shifted to new pursuits and agriculture expanded.

Modern patterns of land use for the region were established around 1857. During this time, there was a shift in emphasis from livestock to growing crops facilitated by drainage and irrigation. However, dry farmed grain was the major crop on the alluvial lands. Droughts and floods during the period hastened this change. Thousands of cattle either starved or were drowned by floodwaters. The first efforts at major crops of cotton took place in the 1870s but it did not become important until the 1920s (Turner 1981). To supply water to increasing agricultural demands, Tulare Lake was incrementally reduced in size by drainage and diversion. By 1922 the lake was almost completely diked and reduced to a small fraction of its former size. Also beginning about this time was the rise of agribusiness, small farms declined and corporate farms increased. The Great Depression of the 1930s also brought in waves of Dust Bowl migrants, and many of the present residents can trace their ancestry to these people.

New farming techniques allowed for leveling and irrigation on a scale never before possible. These practices had devastating results to the regions prehistoric sites and very few remain undisturbed. It is these conditions that characterize the project area today. Artifacts, many with plow and scraper scars, are widely dispersed from their original proveniences. As a result much of the scientific value of the prehistoric items has been lost forever except on the most general level of analysis. Nonetheless, there are small isolated areas within the project area that may contain undisturbed prehistoric deposits. Because of the region’s high sedimentation rates undisturbed archeological sites may be present even in leveled areas but remain deeply buried by sediments (U.S. Bureau of Reclamation 2000).

3.3.2.1 Native American Resources

All of California’s Central Valley is considered Yokut Territory. “Yokuts” is a term applied to a large and diverse number of people inhabiting the San Joaquin Valley and Sierra Nevada foothills of central California. They include the Northern Valley, the Southern Valley, and the Foothill groups. Yokuts were semi-nomadic but maintained regular sites they used seasonally. However, as trade networks were developed, they also may have had contact with or used resources from other areas.

Items traded to and used by the Yokuts included baskets, weaponry, shell, wood, and lithic source material (concentrations of stone waste flakes or tools). Yokut technology is known primarily from the southern Central Valley; no surviving ethnographic examples from the Northern Valley Yokut Tribes are preserved in any known collections. Items traded by the Yokuts perhaps included acorns or baskets made by the Southern Valley Yokuts.

3.4 AGRICULTURAL RESOURCES

The Central Valley is an important agricultural region for both California and the United States, containing almost 80 percent of the irrigated land in California. In 1993, the 19 Central Valley counties contributed more than 60 percent, by value, to California’s agricultural production and included 6 of the top 10 agricultural counties in California. Agriculture in the Central Valley is an important employer and affects the regional economy through the expenses of farmers as well as production of many crops that require processing or transportation after harvest.

The Central Valley accounts for almost all of the United States production of many fruit and nut crops such as almonds, pistachios, walnuts, nectarines, and plums and prunes. In addition, it produces almost 10 percent of the total national market value of crop production, 40 percent of fruits and nuts, 20 percent of cotton, and 15 percent of vegetables. The Central Valley grows almost all of California’s cotton and almonds, and almost three-fourths of its grapes and oranges.

Values of crop production per acre can range from $200 to $15,000 or more. In comparison to the nation as a whole, a large share of Central Valley irrigated land is used to produce high-value crops. High-value crops tend to be used for direct human consumption. They generate more revenue per acre, but they also require more labor and other inputs. Changes in acreages of high-value crops generally have a larger economic impact per acre on agriculture and related industries than do changes in low-value crops.

Irrigated acreage within the San Joaquin River Region is diversified. Almost half of the 1992 acreage was planted with grains, hay, and pasture. Orchards were planted on about 30 percent of the irrigated acres, and cotton and vegetables were each planted on about 10 percent. The region is the leading California area for production of grapes, almonds, walnuts, tomatoes, melons, and many other crops. Vegetables and cotton are grown on the westside, and grapes, fruits, nuts, and cotton are grown on the east side.

The warm climate of the Tulare Lake Region allows for great crop diversity. Cotton leads irrigated acres (32 percent), followed by fruits and nuts (28 percent), grains and field crops (17 percent), hay and pasture (12 percent), and vegetables (10 percent). Tulare County is the leading milk-producing county in the United States. The region has benefited from supplemental water supply provided by the SWP for areas within Kern and Kings counties.

Recent cropping pattern analyses indicate a trend toward decreasing alfalfa/field crops and sharply increasing vegetable production in central California. Gross revenues from vegetable production are expected to comprise 42 percent of the revenue in the San Joaquin River region by the year 2020. Many of these vegetables are grown in the winter; therefore, any disruption in winter water supply could limit vegetable production in the San Joaquin River region.

3.5 LAND USE

Land use can be defined as the human use of land resources for various purposes including economic production, natural resources protection, recreation, or institutional uses. Land uses are frequently regulated by management plans, policies, ordinances, and regulations that determine the types of uses that are allowable or protect specially designated or environmentally sensitive uses.

3.5.1 Regional Setting

In addition to agricultural land uses, discussed in Section 3.4, the Central Valley supports a number of municipal and industrial (M&I) land uses. M&I uses include residential, industrial, commercial, construction, institutional, and public administration purposes, as well as railroad yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment plants, water control structures, and other developments. Highways, railroads, and other transportation facilities are also included as M&I land use if they are located in an M&I region.

Between 1980 and 1990, M&I land acreage within the San Joaquin River Region increased from approximately 71,000 acres to 110,000 acres. Major M&I centers include the cities of Fresno, Stockton, Tracy, Modesto, and Merced, which are industrial hubs for food and grain processing. The cities of Tracy and Stockton have grown recently, fed by the San Francisco Bay Region growth trends. The City of Fresno is the major M&I center for the San Joaquin Valley (U.S. Bureau of Reclamation 2000).

3.6 AIR QUALITY

Air quality relates to the health, environmental, and enjoyment aspects of the atmosphere. Air pollutants can adversely affect human health, damage plant and animal life, and detract from pleasure by causing odors or reducing visibility. Conventional or criteria air pollutants are ozone (O_3), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), inhalable particulates 10 microns or less in diameter (PM_{10}), and lead. Volatile organic compounds (VOCs) are a precursor to ozone. Sources of air pollution include emissions from stationary stack sources, area sources (such as landfills), and mobile sources.

Air pollutants are formed by several processes and can have a number of impacts to health. CO is formed from incomplete combustion of fossil fuels and affects the blood's ability to carry oxygen. SO_2 results from the combustion of sulfur contained in fuels and may inhibit respiratory function. SO_2 is a precursor to acid rain. NO_2, VOC, and ozone all play a role in the complex atmospheric interactions resulting in smog, which adversely affects the respiratory system and visibility. NO_2 is formed from nitrogen in fuel during combustion processes. VOCs may result from evaporation of hydrocarbon liquids or incomplete combustion and through atmospheric chemistry, resulting in ozone formation and the development of smog. PM_{10} emissions are formed by construction and agricultural activities, soil stockpiling, emission control equipment, and atmospheric reactions of NO_2 and SO_2. PM_{10} emissions can also result in the formation of respirable particulates, which are associated with various respiratory illnesses.

The geographic area for the analysis of air quality is limited to the San Joaquin Valley Air Basin (air basin), which includes San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and most of Kern Counties. The San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) is currently in non-attainment with state and federal air quality standards (Table 3-5).

Table 3-5
SJVUAPCD Non-Attainment of Air Quality Standards

Pollutant	Federal Standard	State Standard
Ozone - One hour	Nonattainment/Serious	Nonattainment/Severe
PM_{10}	Nonattainment/Serious	Nonattainment

Source: Air Resources Board 1998.

The air quality in the air basin is among the poorest in the state. On average the air basin experiences 35 to 40 days when the federal health-based standards for ground-level ozone are exceeded and more than 100 days over the state ozone standard. The levels of airborne particles exceed the federal standard less than five times annually, however, because the California standard is set at a lower and more protective level, the air basin exceeds this limit an average of 90 to 100 days per year.

Most of the air pollutants in the study area may be associated with either urban or agricultural land uses. Pollutants commonly associated with agricultural land uses include PM_{10}, CO, nitrogen oxides (NO_x), and ozone precursors. No clear relationship exists between agricultural acres and the occurrence or resulting concentrations of ozone and PM_{10} in the atmosphere. Several variables other than land uses can affect air quality conditions, and these variables may change over time.

Regulation of air quality is achieved through both national and state ambient air quality standards and emission limits for individual sources of pollutants. The national ambient PM_{10} standard is 150 micrograms per cubic meter, whereas the more stringent State standard is 50 micrograms per cubic meter. Both standards are for a 24-hour averaging period.

To meet federal Clean Air Act requirements, the District has adopted an Ozone Attainment Demonstration Plan (1994) and a PM_{10} Attainment Demonstration Plan (1997). In addition, to meet California Clean Air Act requirements, the District has also adopted an Air Quality Attainment Plan (1991) and corresponding updates to address the California ozone standard.

3.7 NOISE

Noise is often defined as "unwanted sound." Depending on its intensity, it has the potential to disrupt sleep, interfere with speech communication, or even damage hearing. Noise is generated by a variety of interior and exterior sources. Exterior noise sources can be mobile or stationary, such as motor vehicles, aircraft, construction work, industrial processes, various human activities, and miscellaneous operations such as emergency vehicles and air conditioning units.

Sound waves, traveling outward from a source, exert a sound pressure, which is commonly assigned a "sound pressure level," measured in decibels (dB - a logarithmic measure of the ratio between sound pressure and the approximate threshold of human hearing). Environmental noise is usually measured in A-weighted decibels (dBA); the A-weighting describes a correction for variations in the typical human ear's frequency response at commonly encountered noise levels. In general, a fluctuation in sound of 1 dBA is noticeable only under laboratory conditions. A change of 3 dBA is just noticeable in field conditions, a 5 dBA change is clearly noticeable and a 10 dBA change is perceptually twice (or half) as loud. For example, a noise level of 70 dBA sounds approximately twice as loud as 60 dBA and four times as loud as 50 dBA.

Federal, state, and local agencies have developed guidelines for evaluating the compatibility of different land uses and various noise levels. In general, noise is not considered a nuisance unless humans are exposed to excessive levels. Generally, counties have established noise standards for the following three land use categories:

- Insensitive Land Uses, for which noise levels do not affect successful operation of activities. Included in this category are transportation and agriculture. The vast majority of the Westlands Water District (WWD) service area and the service areas of the Kern Districts are included in this category.

- Moderately Sensitive Land Uses, for which some degree of noise control must be exercised if activities are to be successfully carried out. General business and recreation are included in this category.

- Sensitive Land Uses, for which lack of noise control results in annoyance impacts. This category primarily includes residential uses.

The main sources of noise in WWD and in the Kern Districts are farm machinery, pumping equipment and vehicular traffic. Due to the undeveloped and rural nature of the area, noise levels are relatively low. There is also noise from Interstate 5, a major transportation corridor, and some of the State Highways.

3.8 GEOLOGY

3.8.1 Regional Setting

The SJV is one of the major geological features of California. SJV is part of a large, northwest-to-southeast-trending structural trough of the Central Valley that has been filled with as much as 6 vertical miles of sediment, which include both marine and continental deposits ranging in age form Jurassic to Holocene. It lies between the Coast Ranges on the west, the Sierra Nevada on the east, and extends northwestward from the San Emigdo and Tehachapi Mountains to the Sacramento-San Joaquin Delta near Stockton, California. SJV is 250 miles long and 50 to 60 miles wide. The almost featureless alluvial floor is interrupted occasionally by low hills.

The deposits of SJV are a mixture of sediments. Some areas are underlain mainly by coarse-grained sediment and others by fine-grained sediment. The deposit that most notably affects groundwater and confinement is the Corcoran Clay Member, deposited about 600,000 years ago. This clay bed covers approximately 5,000 square miles and is up to 160 feet thick beneath the present bed of Tulare Lake.

3.8.2 Soils

The soils on the east side of the SJV tend to be coarse textured, especially on the alluvial fan areas. Some older terraces on the east side are underlain by hardpans, which were ripped during land development operations, making them well suited for orchards and vineyards.

The soils of basin rim areas on the east side of SJV (lower alluvial fans) tend to be saline-sodic in their natural state. Over the years, most of these lands have been reclaimed at considerable expense. Once reclaimed, these soils are used to produce diversified crops.

The fine-textured SJV basin lands are used for field crops. Some of these soils tend to be saline; however, farmers are managing this situation and are successfully growing many field crops on these lands.

The basin rim areas on the westside of SJV tend to be affected by shallow groundwater and are generally saline. These lands are used to grow mostly salt-tolerant crops; however, if planned drainage systems are completed, these lands could be used to grow a wide variety of climatically adapted crops.

The alluvial fan lands on the westside of SJV are generally productive and are used for a wide variety of climatically adapted crops.

3.8.2.1 Soil Drainage Problems in the SJV

Drainage problems in the SJV are a result of irrigated agriculture in an area with shallow groundwater tables and little or no drainage outlet. In a large part of the SJV on the westside and, in particular, WWD, shallow groundwater tables, salts imported by water deliveries, and accumulation of natural salts in soil and groundwater from irrigation threaten sustained agriculture. Increased water supplies to agricultural lands in the western SJV have the potential to exacerbate existing soil drainage problems.

The salt content of irrigation water increases as water evaporates, passes over saline soils, or is consumed by plants. Salts both in the water and in the soil create problems for agriculture by inhibiting plant growth. In extreme cases, high salt concentrations can render the land useless for agriculture.

In areas lacking good drainage, repeated irrigation may raise the water table. When the water table reaches the root zone of plants, capillary action often carries water close to the soil surface, where it evaporates and leaves a salt residue. In time, this process greatly reduces the productivity of the land. Salinity also increases management and operating costs and accelerates corrosion of equipment.

Where drainage is adequate, salts can be flushed from the root zones if there is sufficient rainfall or if additional irrigation water is applied for this purpose. However, this seldom eliminates the salinity problem. If the salts are washed off the land with additional water applications, the return drainage flows will have higher salt concentrations. This may adversely affect plants, fish and wildlife dependent on surface drainage water as well as downstream users. Additionally, high concentrations of naturally occurring elements, such as selenium, may enter return drainage flows and pose a hazard to wildlife and humans when agricultural drainage is discharged to wetlands or water resources.

3.9 RECREATIONAL RESOURCES

3.9.1 Regional Setting

Federal and state wildlife refuges located in the San Joaquin River and Tulare Lake regions provide both consumptive and non-consumptive recreation opportunities. These opportunities are typically associated with the presence of waterfowl and include hunting and observing wildlife. Other activities are fishing and picnicking. Most visitation at the refuges coincides with the presence of waterfowl.

Recreation opportunities are provided by reservoirs in the Trinity, Sacramento River, and San Joaquin River regions. These reservoirs, including Clair Engle Lake, Shasta Lake, Whiskeytown Lake, Lake Oroville, Folsom Lake, Millerton Lake, San Luis Reservoir, and New Melones Reservoir, provide both water-dependent and water-enhanced recreation opportunities. Water-dependent recreation at these reservoirs includes power boating, water skiing, sailing, and fishing. Water-enhanced recreation includes camping, picnicking, hiking, and sightseeing. Most of these activities occur primarily during the summer months, typically May through September. Boating and fishing are typically the most popular year-round recreation activities at the reservoirs.

Rivers below major reservoirs provide important water-dependent and water-enhanced recreation opportunities. Major rivers below CVP and SWP reservoirs are the Trinity, Sacramento, American, Feather, San Joaquin, and Stanislaus. Rivers below reservoirs operated by other agencies are the Yuba, Tuolumne, Merced, Calaveras, and Mokelumne. These rivers provide important water-dependent recreation opportunities, including fishing, power boating, rafting, kayaking, and canoeing. Most of these activities occur during summer months. Fishing is typically the most popular year-round activity.

3.10 SOLID WASTE MANAGEMENT

In 1990, Californians generated approximately 50.9 million tons of waste, or about one ton per second, and disposed of approximately 42.4 million tons. In 1999, California as a whole diverted more than 37 percent of its waste (a 12 percent increase in waste diversion from 1998), resulting in disposal of approximately 37.5 million tons. California's goal, as mandated in the Integrated Waste Management Act of 1989, is to divert 50 percent of its waste. In order to reach these diversion goals, the Integrated Waste Management Board has enumerated four priority target areas: (1) providing customized assistance to local governments to meet their 50 percent diversion goals; (2) improving solid waste facility compliance; (3) improving recycling of construction and demolition debris; and (4) improving organic material recycling, especially yard waste, grass clippings, and food waste.

As a result of recently implemented diversion-oriented programs, significant reductions in waste have been accrued. For example, in the residential sector, which generates approximately 40 percent of California's waste, disposal decreased from about 3.1 pounds per resident per day in 1990 to 2.4 pounds per resident per day in 1997. In the nonresidential sector, accounting for the remaining 60 percent of California's waste stream, disposal decreased from approximately 9.7 pounds per employee per day to 7.8 pounds per employee per day over the same time period. Statewide diversion rates increased from 17 percent in 1990 to 37 percent in 1999, a more than two-fold increase.

There are 61 jurisdictions in the Central Valley South Region, including 3 Board-approved regional agencies: Kings Waste and Recycling Authority, Merced County Solid Waste Regional Agency, and Consolidated Waste Management Authority of Tulare County. Jurisdictions in this region disposed 3,177,785 tons in 1998, all of which were disposed of in California. This is approximately 8 percent of the statewide disposal amount. Percentages of waste diverted by Central Valley South Region counties mirror those of California generally.

Solid wastes that may be created or brought onto agricultural lands include, but are not limited to:

- Plastic plant pots, fertilizer, feed and silage bags, poly rope and twine, tarps, and barrels used to ship and store chemicals, oil, solvents, fertilizer and polyethylene from greenhouses;
- Glass jars, bottles, greenhouse windows;
- Metal agri-chemical containers, wire, packaging and construction materials;
- Wood sawdust, shavings, lumber, prunings and tree stumps, fence posts, pallets, demolished structures, paper, fertilizer and chemical bags, wrapping;
- Cardboard boxes (waxed and unwaxed); and
- Media rock wool, peat, bark.

3.11 HAZARDOUS MATERIALS/WASTE MANAGEMENT

Hazardous materials and wastes are those substances defined as hazardous by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (42 U.S.C. 9601-9675), the Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act (RCRA) (42 U.S.C. 6901-6992), and Title 22 of the California Code of Regulations (CCR). In general, this includes substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, would present substantial danger to public health and welfare or to the environment when released.

Common hazardous materials used in agricultural operations include:

- *Automotive products* - including motor oil, brake and transmission fluid, antifreeze, car batteries, gasoline, kerosene, diesel fuel, and car wax with solvent.
- *Household cleaners* - including drain cleaners, oven cleaners, toilet cleaners, spot removers, silver polishes, furniture polishes, liquid cleanser, powdered and window cleaners, bleach, and dyes.
- *Paint and solvents* - including latex, oil-based, auto and model paint, paint stripper, primer, rust remover, turpentine, varnish, wood preservative, mineral spirits, and glues.
- *Pesticides* - including herbicides, insecticides, and fungicides.

The Hazardous Waste Management Program (HWMP) regulates hazardous waste through its permitting, compliance assurance, and Unified Program activities. HWMP maintains the U.S. Environmental Protection Agency (U.S. EPA) authorization to implement the RCRA program in California, and develops regulations, policies, guidance and technical assistance/training to assure the safe storage, treatment, transportation, and disposal of hazardous wastes.

3.12 SOCIOECONOMICS

3.12.1 Regional Setting

The southern segment of the Central Valley, constituted by Merced, Stanislaus, Kern, San Joaquin, Kings, Madera, Tulare, and Fresno Counties, is home to over three million residents, or approximately 10 percent of the total population of California. The labor force for this region totals nearly 1.5 million workers. Unemployment rates, which are residency-based labor market statistics, are consistently higher in the region than in the adjacent regions due to the significant seasonal nature of the region's employment. The average rate in the region in 1998 was 13.1 percent, down from 15.8 percent in 1993. Because the region offers a ready supply of homes at relatively low prices, many workers who commute to the Bay Area region live in San Joaquin Valley communities. Table 3-6 details population, labor force, and unemployment rate statistics for each county within this region.

Table 3-6
Central Valley Demographics 1998

	Population	Total Labor Force	Unemployment Rate
Merced County	198,450	86,000	18.0%
Stanislaus County	415,305	200,600	13.2%
Kern County	624,715	277,300	14.0%
San Joaquin County	529,375	246,700	11.5%
Kings County	118,800	43,480	18.0%
Fresno County	760,900	372,300	16.8%
Madera County	108,850	50,820	13.7%
Tulare County	351,400	162,900	19.8%
Total	**3,147,795**	**1,440,100**	**13.1% (average)**

Source: California Central Valley Economic Development Council 2000

Agriculture is the predominant form of employment, and comprises approximately 18 percent of aggregate employment. In total, approximately 222,000 persons in this region are employed in some capacity in the agricultural sector. Following agriculture, in order by the number of jobs provided, are service, government, retail trade, and manufacturing. Table 3-7 shows county-specific industry sector breakdowns of employment distributions.

Table 3-7
Labor by Industry Sector (percent) 1998

	Ag-Forestry-Fishing	Manufacturing	Retail Trade	Services	Government
Merced	18.5	18.0	17.0	14.0	20.2
Stanislaus	10.8	18.4	18.5	21.1	16.3
Kern	22.0	4.4	15.3	18.4	21.1
San Joaquin	8.7	13.2	17.3	22.5	18.6
Kings	27.0	9.2	15.4	13.1	26.0
Fresno	21.9	8.6	14.7	19.7	18.7
Madera	23.2	9.9	15.7	20.9	15.1
Tulare	28.9	9.6	15.8	13.7	19.4

Source: California Central Valley Economic Development Council 2000

Workers employed in mining/construction, transportation/communications/utilities, wholesale trade, and finance/insurance/real estate comprise between 9.3 percent and 19.7 percent of the total labor force in the respective counties.

The leading manufacturing industry in the region is that of food and related products, which comprises approximately $5.5 billion in gross yearly revenue. The largest portions contributing to this total come from Stanislaus County (with nearly $2 billion annually) and San Joaquin County (with approximately $1.3 billion). Following this industry in terms of gross yearly revenue in the region are industry sectors such as paper, chemicals, and allied products (totaling nearly $600 million), stone, clay, glass and concrete products (totaling approximately $450 million), and printing and publishing (totaling approximately $435 million).

3.13 HEALTH AND SAFETY

In 1970, Congress established the Occupational Safety and Health Administration (OSHA). As defined in its enabling legislation, P.L. 91-596, *the Occupational Safety and Health Act* of 1970, OSHA's mission is to "Assure so far as possible every working man and woman in the Nation safe and healthful working conditions." This mandate involves the application of a set of tools by OSHA (e.g., standards development, enforcement, compliance assistance) which enable employers to maintain safe and healthful workplaces. In the project area, OSHA covers federal employees and facilities.

California administers its own workplace safety and health program according to provisions of the Federal Occupational Safety and Health Act of 1970. The Act permits a state to manage its own occupational safety and health program if it meets certain federal requirements. Cal/OSHA is the California program approved by federal OSHA. The Department of Industrial Relations has administered the Cal/OSHA program since 1973 when California's plan was approved.

Cal/OSHA covers virtually all workers in the state, including those employed by state and local government. Cal/OSHA does not cover federal employees, offshore maritime workers, or domestic service workers in private households.

3.14 VISUAL RESOURCES

Visual resources are areas that are considered valuable due to their aesthetic attributes and the desirability of maintaining those attributes.

3.14.1 Regional Setting

The visual landscape of the San Joaquin River regions has changed considerably since before World War II. In the 1940s, the valley was largely open grasslands with scattered expanses of oak woodland. Wetlands, vernal pools, and riparian corridors added visual variety to the landscape. Settlement was sparse, with small communities, located primarily along the rivers, and scattered rural ranches. A significantly smaller area of the landscape was irrigated and few of the rivers were regulated. Much of the view opportunity was limited to the road and railroad corridors.

After the population influx following World War II, rapid agricultural development and the growth of communities changed the visual landscape substantially and relatively quickly. Much of the grassland was replaced by irrigated cropland, rice fields, and orchards. Most of the wetlands, vernal pools, and riparian corridors were eliminated.

Construction of dams and reservoirs substantially altered the visual character of valleys in which reservoirs were constructed. The reservoirs added visual variety, because large water bodies are widely perceived as features of high visual interest, but changed the visual character provided by free-flowing streams. CVP canals also added visual variety to the landscape by their form and water feature qualities.

The Delta landscape once consisted of a vast system of wetlands and river channels. The construction of levees, beginning in the 1850s, dramatically changed the visual setting. The establishment of settlements in the Delta began in the mid-1800s. Continued urban growth has substantially altered the visual aspect of the Delta margins.

3.15 UTILITIES

Electricity

Within the Central Valley region there is a well established infrastructure for the delivery of electricity. There is ample capacity in place for increased electrical demand. The current deregulation of the electric industry in California will provide businesses in the project area with more options and lower electrical costs.

Natural Gas

Interconnecting pipelines to extensive gas reserves located in Canada and the Midwest provide the Central Valley region with an abundant supply of natural gas. Pricing deregulation has produced competitive gas prices for businesses in the Central Valley.

Water

A well-established infrastructure consisting of CVP, SWP, and local facilities is in place for delivery in the present with capacity for future growth.

Communications

Central Valley communication infrastructure is among the best in the state. Communication companies are providing the entire region with state-of-the-industry technology, facilities, and services.

3.16 ENVIRONMENTAL JUSTICE

Executive Order (EO) 12898, "General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," requires all federal agencies to adopt strategies to address environmental justice concerns within the context of agency operations.

The 1990 Census of Population and Housing reports numbers of both minority and property residents. Minority populations included in the census are identified as Black; American Indian, Eskimo, or Aleut; Asian or Pacific Islander; Hispanic; or Other. Poverty status (used in this EA to define low-income status) is reported as the number of families with income below poverty level ($12,764 for a family of four in 1989, as reported in the 1990 Census of Population and Housing). Table 3-8 details county-specific poverty statistics. Table 3-9 provides population estimates for counties by race and Hispanic origin.

Table 3-8
Individuals Below Poverty Level by County 1996

	Number of Individuals	Percent
Calaveras County	4,405	11.3
Tuolumne County	6,052	12.3
Mariposa County	2,163	13.4
Stanislaus County	72,281	17.3
San Joaquin County	98,627	18.7
Kern County	124,931	20.6
Madera County	22,239	20.8
Kings County	22,999	22.3
Fresno County	188,008	25.2
Merced County	50,278	25.9
Tulare County	98,969	28.2

Source: U.S. Census Bureau, Small Area Income and Poverty Estimates Program 1999a.

Table 3-9
Population Estimates for Counties by Race and Hispanic Origin: July 1, 1998

	Total	Total White	White Hispanic	White non-Hispanic	Total Black	Total American Indian	Total Asian and Pacific Islander	Total Hispanic
Calaveras County	39,830	38,299	2,766	35,533	262	907	362	2,962
Fresno County	755,730	625,900	302,940	322,960	39,648	9,527	80,655	320,225
Kern County	631,459	550,108	204,283	345,825	41,215	11,086	29,050	221,811
Kings County	118,866	101,236	46,635	54,601	10,319	1,728	5,583	49,547
Madera County	114,748	106,138	46,424	59,714	4,148	2,255	2,207	48,441
Mariposa County	15,877	14,746	968	13,778	173	756	202	1,089
Merced County	197,730	165,038	73,817	91,221	9,569	2,160	20,963	78,114
San Joaquin County	550,445	425,471	144,959	280,512	31,953	6,059	86,962	158,260
Stanislaus County	426,460	384,075	114,147	269,928	7,962	5,164	29,259	118,796
Tulare County	355,240	322,136	156,912	165,224	5,978	6,072	21,054	164,775
Tuolumne County	53,248	49,553	4,826	44,727	1,932	1,152	611	5,147

Source: U.S. Census Bureau, Population Estimates Program 1999b.